MULTI-SCALE MODELING AND ANALYSIS FOR DESIGN OF ADVANCED STEELS

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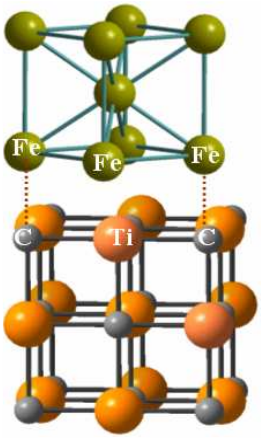
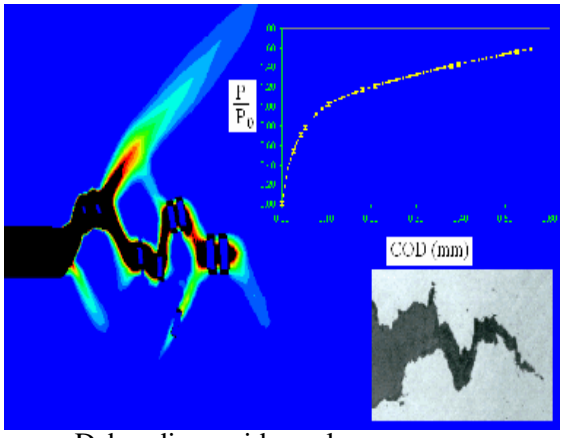
Strength and fracture toughness are the primary property-indices for steels. Combining these two conflicting properties motivates this ONR-funded project at Northwestern University focused on the multiscale/quantum design of new "triple-phase" high toughness plate steels for blast resistant applications. In order to establish the relationships among alloys selection, heat treatment process, micro/nano-structural parameters and ductile fracture toughness, a computation-based hierarchical material design model is developed that links mechanisms at the quantum scale by considering the inclusion/iron matrix interfacial debonding within a two-level (micro and sub-micro) cell models incorporating the plastic deformation induced phase transformation in the iron matrix for the prediction of fracture toughness [1-9].



Interfacial separation at atomic scale



Debunding-voids coaleasence induced ductile crack growth

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